Equations

Problem 8.26

A cylindrical 1045 steel bar is subjected to repeated compression-tension stress cycling along its axis. If the load amplitude is ...

$$F_{amplitude} = 66700 \ [\text{N}] \tag{1}$$

Compute the minimum allowable bar diameter to ensure that there is no fatigue failure. Use FS = 2.0

$$FS = 2.0 \tag{2}$$

Solution

From Figure 8.44 the endurance limit of the material is about ..

$$\sigma_{endurance} = 320 \ [\text{MPa}] \tag{3}$$

Use the factor of safety, and get the working stress amplitude

$$\sigma_{amplitude} = \sigma_{endurance}/FS \tag{4}$$

And then calculate the area and diameter

$$\sigma_{amplitude} = F_{amplitude}/A \tag{5}$$

$$A = \pi/4 \cdot d^2 \tag{6}$$

Solution

$$A = 416.9 \ [\text{mm}^2] \qquad d = 23.04 \ [\text{mm}]$$
$$FS = 2 \qquad\qquad F_{amplitude} = 66700 \ [\text{N}]$$
$$\sigma_{amplitude} = 160 \ [\text{MPa}] \quad \sigma_{endurance} = 320 \ [\text{MPa}]$$